

REMARKS

(1) Claims 1-10 and 21-32 are pending in the present application. Applicant amended independent claims 1, 21, and 27 herein, but no new matter has been added.

(2) The Office Action cited the following references:

A. U. S. Patent 5,930,670, by Park, entitled *Method Of Forming A Tungsten Plug Of A Semiconductor Device* (referred to as “Park” hereinafter);

B. U. S. Patent 6,239,010 B1, by Lu, entitled *Method For Manually Manufacturing Capacitor* (referred to as “Lu” hereinafter);

C. U. S. Patent 6,610,597 B2, by Kobayashi, entitled *Method Of Fabricating A Semiconductor Device* (referred to as “Kobayashi” hereinafter); and

D. U.S. Patent 6,268,090 B1 by Matsubara, *et al.*, entitled *Process For Manufacturing Semiconductor Device And Exposure Mask* (referred to as “Matsubara” hereinafter).

(3) Claims 1-7, 10, 21-23, 25-29, 31, and 32 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Park in view of Lu. Claims 8 and 9 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Park in view of Lu and further in view of Kobayashi. Claims 24 and 30 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Park in view of Lu and further in view of Matsubara. Applicant respectfully traverses these rejections for the following reasons.

Claims 1-10 and 21-32

Although the scope of claims 1-10 and 21-32 differ, a same set of arguments may be made to overcome the obviousness rejections and to show that the present invention is patentable over the prior art. Independent claim 1 includes, for example, a step of “stopping said polishing so as to leave a reduced thickness of said tungsten layer adjacent to said aperture so that said tungsten layer is not separated from a bottom of said aperture during said polishing.” Although

different, independent claims 21 and 27 both include, for example, a step of “stopping said polishing to leave a reduced thickness portion of said metal layer adjacent to said aperture so that said tungsten layer is not separated from a bottom of said aperture during said polishing.”

Regarding obviousness, MPEP 2143 (8th ed., rev. 2, May 2004) states:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

With respect to the third criterion, *all* the claim limitations must be taught or suggested by the prior art.

As the Office Action states, “Park does not disclose polishing the tungsten layer.” The Office Action asserts that the polishing disclosed in Lu may be applied in the method of Park. The Office Action states that “it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Park by polishing the metal layer as taught by Lu.”

However, it is not obvious to apply the polishing step disclosed in Lu to the method of Park because *polishing* will not work and is not feasible in Park to obtain the desired structure of Park. That is why Park only teaches *etching*. Park only discloses *etching* because it is dealing with a non-planar top surface in its structure, which is why Park uses *etching*. To *polish* the structure of Park would exasperate the problem that Park is trying to solve; i.e., removing tungsten residue in an inclined portion (S1, S2, S3) (see e.g., FIGs. 1C, 2C, and 3C; col. 3, lines 55-60; col. 4, lines 56-60 of Park) other than at the contact hole (see e.g., col. 2, lines 9-13 of Park).

Independent claims 1, 21, and 27 require *polishing* a metal layer to remove a top portion of the metal layer. Although Park discloses removing a top portion of a tungsten layer, it is by *etching*, not *polishing*. It is the polishing step that is causing failures in integrated circuit chips by metal plug pull-ups and pull-outs. Because the method of Park does not use polishing to

remove a top portion of the metal layer, this problem is not likely to arise using Park's method (i.e., etching).

In Lu, the metal plug material *filling* the aperture is polished, but the polishing is not stopped so as to leave a reduced thickness of the metal layer (that *fills* the aperture) *adjacent to* the aperture *so that* the metal layer is *not separated from a bottom of the aperture during the polishing*, as independent claims 1, 21, and 27 now require. Thus, the polishing step and method of forming the tungsten plug in Lu is no different from the prior art process shown in FIGs. 3A-3C of the present application. The method of Lu will still have the same likelihood of causing failures in an integrated circuit chip caused by metal plug pull-ups and pull-outs. Thus, Park and Lu (singularly or combined) do not teach, suggest, disclose, or motivate the methods provided by independent claims 1, 21, and 27. Accordingly, claims 1, 21, and 27 are patentable over Park in view of Lu.

Regarding Kobayashi, this reference does not disclose or motivate *polishing*. Kobayashi only discloses *etching* a tungsten layer to form a tungsten plug. Thus, Kobayashi does not provide any added teaching, suggestion, or motivation toward the inventions of claims 8 and 9, in light of the arguments above regarding Park and Lu.

Regarding Matsubara, this reference teaches a method of polishing with the same short comings as the Lu reference (i.e., causing the metal layer to be separated from the bottom of the aperture, plug pull-out, as discussed above). Thus, Matsubara does not provide any added teaching, suggestion, or motivation toward the inventions of claims 21 and 27, in light of the arguments above regarding Park and Lu. Therefore, none of the prior art references, taken along or combined, provide of method of polishing a metal layer and stopping the polishing so that the metal layer is not separated from the bottom of the aperture during the polishing, which is a critical problem solved by the present invention.

Claims 2-10 depend from claim 1, claims 22-26 depend from claim 21, and claims 28-32 depend from claim 27. Without conceding that Examiner's assertions are valid with respect to the limitations of the rejected dependent claims, Applicant respectfully submits that claims 2-10, 22-26, and 28-32 are patentable over the prior art, not only because of their dependency from

claims 1, 21, and 27, respectfully, for the reasons discussed above, but also in view of their novel and non-obvious claim features.


If the rejections of claims 1-10 and 21-32 should be maintained, it is respectfully requested that the Patent Office point out with particularity how and where Park and/or Lu, either singularly or combined, discloses *all* of the required limitations of claims 1-10 and 21-32. In the absence of a *prima facie* showing of obviousness by the Patent Office, Applicant submits that claims 1-10 and 21-32 should now be allowed.

(4) In view of the above, Applicant respectfully submits that the application is in condition for allowance and requests that the case be passed to issuance. If the Examiner should have any questions, Applicant requests that the Examiner contact Applicant's attorney at the address below. No fee is believed due in connection with this filing. However, in the event that there are any fees due, please charge the same, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

3/21/2005

Date



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